भारतीय मानक
Indian Standard

IS 16185 : 2014
(Reaffirmed 2019)

गैस सिलिंडर — वेल्डित कार्बन इस्पात गैस सिलिंडर — आवधिक निरीक्षण एवं परीक्षण — रीति संहिता

Periodic Inspection and Testing — Welded Carbon Steel Gas Cylinders — Code of Practice

ICS 23.020.30

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March 2014 **Price Group 6**

Cylinders Sectional Committee, MED 16

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Gas Cylinders Sectional Committee had been approved by the Mechanical Engineering Division Council.

This standard has been formulated as a guide to cylinder fillers for establishing their own cylinder inspection procedures and standards. It should be distinctly understood that it shall not cover all circumstances for each individual cylinder type. Rejection or acceptance for continued use in accordance with their cylinders are or are not dangerous or subject to impending failure, but represents practice which has been satisfactory to a cross-section of the industry.

Experience in the inspection of cylinders is an important factor in determining the acceptability of a given cylinder for continued service. Users lacking this experience and having doubtful cylinders should return them to a manufacturer of the same type of cylinders for re-inspection.

In the formulation of this standard considerable assistance has been taken from ISO 10460 : 2005 'Gas cylinders — Refillable welded steel cylinders — Period inspection and testing'.

While implementing this standard compliance with statutory regulations shall be ensured.

The composition of the Committee responsible for the formulation of this standard is given in Annex C.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

PERIODIC INSPECTION AND TESTING — WELDED CARBON STEEL GAS CYLINDERS — CODE OF PRACTICE

1 SCOPE

This standard specifies the requirements for periodic inspection and testing of refillable welded carbon steel gas cylinders intended for compressed, liquefied (excluding DA) under pressure, of water capacity from 5 litre up to and including 250 litre to verify the integrity for further service. It also applies, as far as practicable, to cylinders of less than 5 litre water capacity.

This standard does not apply to the periodic inspection and testing of acetylene cylinders or composite cylinders.

This standard is primarily for industrial gases other than liquefied petroleum gas (LPG). For specific LPG applications (*see* IS 16054).

2 REFERENCES

The following standards contain provisions, which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revisions and parties to agreements based on this standard are encouraged to investigate the possibility of apply the most recent editions of the standards indicated below:

IS No.	*Title*
2 : 1960	Rules for rounding off numerical values (*revised*)
3224 : 2002	Valve fittings for compressed gas cylinders excluding liquefied petroleum gas (LPG) cylinders — Specification (*third revision*)
5844 : 1970	Recommendations for hydrostatic stretch testing of compressed gas cylinders
7241 : 1981	Glossary terms used in gas cylinder technology
8868 : 1988	Periodical inspection interval of gas cylinders in use
16054 : 2012	Periodic inspection and testing welded low carbon steel cylinders exceeding 5 litre water capacity for liquefied petroleum gas (LPG) — Code of practice.

3 TERMINOLOGY

For the purpose of this standard, the following definitions in addition to those given in IS 7241 shall apply.

3.1 Competent Authority — Any national body or authority designated or otherwise recognized as such for any purpose in connection with this standard.

3.2 Competent Person — Person who by a combination of training, experience and supervision is able to make objective judgments on a subject, authorized by the Competent/Statutory Authority.

3.3 Periodic Inspection — Activities carried out at defined intervals or earlier when necessary, including but not limited to examining, measuring, testing or gauging the characteristics of a cylinder and comparing these with specified requirements as defined in the cylinder design, standard and marking to attest conformity with the standard.

3.4 Periodic Inspection Test Station — Place where cylinders are tested and periodically inspected, approved by the competent authority.

3.5 Tare Weight — Sum of the empty weight, the weight of the valve including a dip tube where fitted and the weight of all other parts that are permanently attached to the cylinder when it is being filled, for example the fixed valve protection ring/guard/foot-ring, etc.

4 LIST OF PROCEDURES FOR PERIODIC INSPECTION AND TESTS

Each cylinder shall be submitted to periodic inspections and testing. The following procedures form the basic requirements for such inspection and testing:

a) Identification of cylinder and preparation for inspection and test (*see* **6**);
b) External visual inspection (*see* **7**);
c) Internal visual inspection (*see* **8**);
d) Supplementary tests (*see* **9**);
e) Verification of tare weight (*see* **10**);
f) Inspection of cylinder neck/shoulder (*see* **11**);
g) Hydraulic test (*see* **12**);
h) Final operations (*see* **13**); and
j) Rejection and rendering cylinders unserviceable (*see* **14**);

When the condition of the cylinder remains in doubt after these inspections and tests have been carried out, additional tests shall be necessary.

5 INTERVALS BETWEEN PERIODIC INSPECTION AND TESTS

The interval between periodic inspection and tests is specified in IS 8868 or as specified by the competent authority.

6 IDENTIFICATION OF THE CYLINDER AND PREPARATION FOR THE INSPECTION AND TEST

Before any work is carried out, the cylinder and its contents and ownership shall be identified with respect to design standard, Sl No., manufacturer's name, tare weight and mark of inspecting authority and record shall be maintained. All cylinders whose identity cannot be established shall be rendered un-serviceable and scrapped as per established procedure. Cylinders with unknown gas contents or those which cannot be safely emptied of gas shall be duly identified and shall be set aside for special handling.

The cylinder shall be firstly depressurized and emptied in a safe controlled manner in an area intended for the purpose and approved by statutory authority. Particular attention shall be given to cylinders containing toxic, irritating or flammable gases to eliminate risk at the internal inspection stage.

Before removing any pressure-retaining accessory (valve, flange, etc), a positive check shall be performed to ensure that the cylinder does not contain any gas under pressure. This can be performed as described in Annex A using a device such as shown in Fig. 1.

Cylinders with in-operative or blocked valves can be treated as outlined in Annex A.

Provided the requirements above have been complied with, and the cylinder has been de-pressurized safely, the valve shall be removed.

7 EXTERNAL CLEANING OF CYLINDERS

7.1 The cylinder shall be cleaned and have all loose coatings, corrosion products, tar, oil or other foreign matter, as well as any labels or transfers, removed from its external surface by a suitable method, for example, by steel wire brushing, shot blasting, water-jet abrasive cleaning, chemical cleaning or other suitable method. Care shall be taken to avoid damage to the cylinder (*see* Annex B).

7.2 External Visual Inspection

The external surface of each cylinder shall then be inspected for,

a) dents, cuts, gouges, bulges, cracks, laminations or excessive base wear (*see* Table 1);
b) heat damage, torch or electric arc burns (*see* Table 1);
c) corrosion (as defined in Table 2);
d) other defects such as illegible or unauthorized stamp markings, unauthorized additions or modifications;
e) integrity of all permanent attachments; and
f) vertical stability (if relevant) (as defined in Table 1).

For rejection criteria, shall be as per Annex B. Cylinders no longer suitable for future service shall be rendered unserviceable (*see* **14**).

8 INTERNAL VISUAL INSPECTION

Purge the cylinder before starting the internal visual inspection. After removing any residual liquid from the de-pressurized cylinder, the whole of its internal surface shall be inspected using an appropriate illuminated explosion free device (for example, a low voltage lamp) to identify any defects similar to those listed in **7.2** (a) and **7.2** (c) that may affect its integrity. Any cylinder showing presence of foreign matter or signs of more than minor surface corrosion shall be cleaned internally mechanically to free it from loose scale or foreign matter without damaging the cylinder walls. Controlled shot blasting, water-jet abrasive cleaning, flail, steam-jet cleaning, hot-water-jet cleaning, rumbling, chemical cleaning or other suitable method may be adopted. The cleaned cylinder shall be again inspected.

9 SUPPLEMENTARY TESTS

Where there is doubt concerning the type and/or severity of a defect found on visual inspection, additional tests or methods of examination may be applied, for example, ultrasonic or radiographic techniques, hydrostatic stretch test or other non-destructive tests. Alternatively the cylinder shall be scrapped. The reason of scrapping of cylinder shall be recorded.

10 VERIFICATION OF THE CYLINDER TARE WEIGHT

The stamps marked on the cylinder shall be scrutinized to determine its initial tare weight when manufactured. In absence of the same the cylinder shall be scrapped unless the competent authority specifies a floor/minimum value for the type of cylinders being inspected.

After external and internal cleaning, the cylinder shall be checked for tare weight. Cylinder having lost its weight more than 5 percent of original tare weight shall be rejected.

11 INSPECTION OF THE CYLINDER THREADS

11.1 Suitable thread cleaning devices shall be used to clean the threads.

11.2 The internal neck threads of the cylinder and other internal threaded openings, for example, for safety devices, shall be examined to ensure that they are of full form, clean and free from burrs, cracks and other imperfections. Appropriate thread plug gauges shall be used to check the neck threads.

11.3 External neck threads and other external threads shall be examined for integrity and for thread damage.

11.4 Where necessary, and where design permits, damaged threads may be rectified by a suitable method and checked with the appropriate gauge after rectification. Record of such cylinder shall be maintained.

12 HYDRAULIC TEST

Each cylinder shall be submitted to a hydraulic pressure test using a suitable fluid, normally water, as the test medium. The test pressure shall be established from the marking on the cylinder.

12.1 Hydrostatic Test

12.1.1 *Preparation of Cylinders*

The external surface of the cylinder shall be clean and completely dry so that any leak can be detected during the test.

12.1.2 *Test Equipments*

All pipework, flexible tubing, valves, fittings and other components forming the pressure system of the test equipment shall be designed to withstand a pressure of 1.5 times the maximum test pressure of cylinder to be tested. The design and the installation of the equipment and the cylinders connected to it shall ensure that no air is trapped in the system.

Equipment shall be either rotary type or invertible type to facilitate examination of complete surface of the cylinder. Equipment shall be provided with isolation valve to isolate the system once the test pressure is reached.

Dedicated pressure gauges for each cylinder to read the cylinder test pressure in accordance to relevant Indian Standard shall be provided. In addition to these two numbers of main gauges shall also be provided on the inlet line of the equipment after the isolation valve. The gauges shall be as per *Gas Cylinder Rules*, 2004.

The gauges shall be calibrated for accuracy against a master gauge at regular interval of minimum once in a month. The master gauge shall be recalibrated in accordance with *Gas Cylinder Rules*, 2004.

A device shall be fitted in the test equipment to ensure that no cylinder is subjected to pressure in excess of its test pressure by more than 10 percent.

12.1.3 *Procedure*

The cylinder shall be tested at the test pressure.

Before applying pressure, the external surface of the cylinder shall be dry and in such a condition that any leak can be detected. Cylinder shall be positioned so the welds are visible during the test. During test the pressure shall be increased gradually till the required test pressure is reached. Then the cylinder shall be isolated from the pumping system and the pressure shall be retained for a period of not less than 30 s. During the test, the cylinder shall be gently tapped with wooden/nylon hammer near the weld joints.

The cylinder shall be thoroughly examined externally for any leak. Any reduction in pressure noticed during this retention period or leakage, visible bulge of deformation, sweating on cylinder body shall be treated as a case of failure in the test.

In case of a leakage in the pressure system, it shall be corrected and the cylinder re-tested.

12.1.4 Cylinder that do not leak or show any visible permanent distortion/deformation shall be deemed to have satisfied the requirement of hydrostatic test. Any cylinder that fails shall be rejected, no repair shall be allowed.

12.2 Hydrostatic Stretch Test

When the condition of the cylinder remains in doubt after inspections as per **4** (b) then additional tests are necessary, such cylinders shall be subjected to hydrostatic stretch test as per IS 5844. Permanent stretch suffered by cylinder due to application of the test pressure shall not exceed the following limits:

a) In the case of cylinders below 20 litre water capacity, 10 percent of the total stretch suffered during test; and
b) In other cases, 10 percent of the total stretch suffered during the test or 1/5 000 of the original volume of the cylinder, whichever is less.

13 FINAL OPERATIONS

13.1 Drying, Cleaning, Painting and Coating

13.1.1 *Drying and Cleaning*

The interior of each cylinder shall be thoroughly dried by dry/hot compressed air. The interior of the cylinder shall be inspected immediately to ensure that it is dry and free from contamination. Any contamination shall be removed using a suitable method.

13.1.2 *Painting and Coating*

Cylinders are sometimes repainted using paints that require stoving. Plastic coats may also be reapplied. Painting or coating shall be applied so that all the markings stamped on the cylinder remain legible.

In no case the temperature of the cylinder shall notexceed 300°C, since overheating could change the mechanical properties of the cylinder.

13.2 Re-Valving of the Cylinder

Before re-valving the cylinder, the thread type shall be identified. The appropriate valve shall be fitted.

The valve shall be fitted to the cylinder using a suitable jointing medium and the optimum torque necessary to ensure a seal between the valve and the cylinder.

The torque applied shall be determined on the basis of the size, form and taper of the threads, the material of the valve and the type of jointing material used.

A torque wrench may be used to establish the torque required for proper thread engagement. Torque shall be sufficient to obtain the required number of thread engagements. The torque specified in IS 3224 shall be adhered to.

13.3 Tare Weighment

The cylinder fitted with valve shall be weighed for tare. The weighing scale used shall have a least count of not more than 10 g and the value of tare weight may be rounded to the nearest 100 g as per IS 2. The weighing scale shall be of adequate weighing capacity.

13.4 Reference to Next Test Date

The next test date may be indicated using an appropriate method. A standard indicating the month and year of the next re-test shall be permanently marked on a disc fitted between the valve and the cylinder or at any other non-detachable part as per IS 8868.

13.5 Marking

After satisfactory completion of the periodic inspection and test and the re-valving of the cylinder, each cylinder shall be permanently marked as per the statutory requirement, with:

a) Symbol of the inspection body or test station;
b) Present test date (indicated by the month and year); and
c) New tare weight of cylinder according to **13.3** shall be punched on cylinder at appropriate place.

The markings should preferably be not less than 6 mm in height but in any case shall not be less than 3 mm in height.

When a marking collar is fitted it shall be used. When there is no space available, markings may be stamped on the shoulder, if its thickness is greater than the cylinder wall thickness.

13.6 Records

An inspection/test record shall be retained by the testing station for not less than the period between tests or as specified by the *Gas Cylinder Rules*, 2004. It shall record sufficient information to identify positively the cylinder and the results of the test/inspection. The test record shall include the following information:

a) Owner;
b) Serial number;
c) Date of the previous test;
d) Manufacturer;
e) Manufacturing specifications;
f) Water capacity;
g) Cylinder tare weight as tested;
h) Test pressure;
j) Inspection/test date;
k) Results of the inspection/test;
m) Inspection performed; and
n) Details of any modification or repair made to the cylinder.

14 REJECTION AND DESTRUCTION OF UNSERVICEABLE CYLINDERS

The decision to reject a cylinder may be taken at any stage during the inspection and test procedure. A rejected cylinder shall not under any circumstances be re-issued into service. It shall be destroyed by the testing station, under intimation to the owner. Complete record of such cylinders shall be maintained. In case of any disagreement, ensure that the legal implications of contemplated action are fully understood.

The markings on the cylinder shall be obliterated.

Prior to taking any of the following actions, ensure the cylinder is empty (*see* **6**).

The following destruction methods may be employed:

a) Crushing the cylinder by mechanical means;
b) Burning an irregular hole in the shoulder equivalent in area to approximately 10 percent of the area of the shoulder;
c) Irregular cutting of the cylinder into three or more pieces; and
d) Hydraulic bursting using a safe method.

ANNEX A

(*Clause* 6)

PROCEDURE TO BE ADOPTED WHEN A CYLINDER VALVE IS SUSPECTED TO BE OBSTRUCTED

A-1 If there is any doubt when the valve of a gas cylinder is opened, that gas is not being released and the cylinder may still contain residual gas under pressure, a check shall be made to establish that the free passage through the valve is not obstructed.

The method adopted shall be a recognized procedure such as one of the following or one that provides equivalent safeguards:

a) For cylinders of liquefied gases, first check to establish that the weight of the cylinder is the same as the tare weight stamped on the cylinder. If there is a positive difference, the cylinder may contain either liquefied gas under pressure or contaminants;

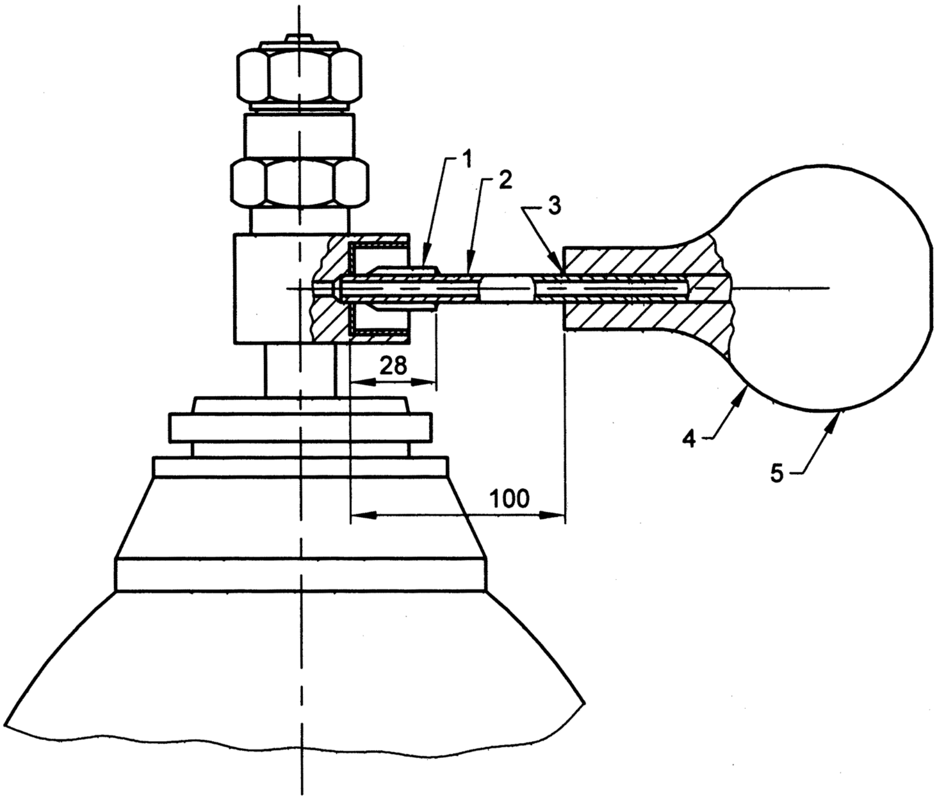
b) Introduce inert gas at a pressure of up to 5 bar and check its discharge; and

c) Use the device shown in Fig.1, to pump air into the cylinder, by hand.

A-2 When it is established that there is no obstruction to gas flow in the cylinder valve, the valve may be removed.

A-3 When a cylinder is found to have an obstructed gas passage in the valve, the cylinder shall be set aside for special attention as follows:

a) Saw or drill the valve body until interception is made with the gas passage between the valve body stem and valve spindle seat;



Key

1) Rubber Tube (Internal Diametre 8 mm, External Diametre 13 mm) Ground to Olive Shape and Bonded
2) Copper Tube (Internal Diametre 3 mm, External Diametre 8 mm)
3) Bonded
4) Rubber Bulb
5) Hand Pressure

All dimensions in millimetres.

FIG. 1 TYPICAL DEVICE FOR DETECTING OBSTRUCTED CYLINDER VALVE

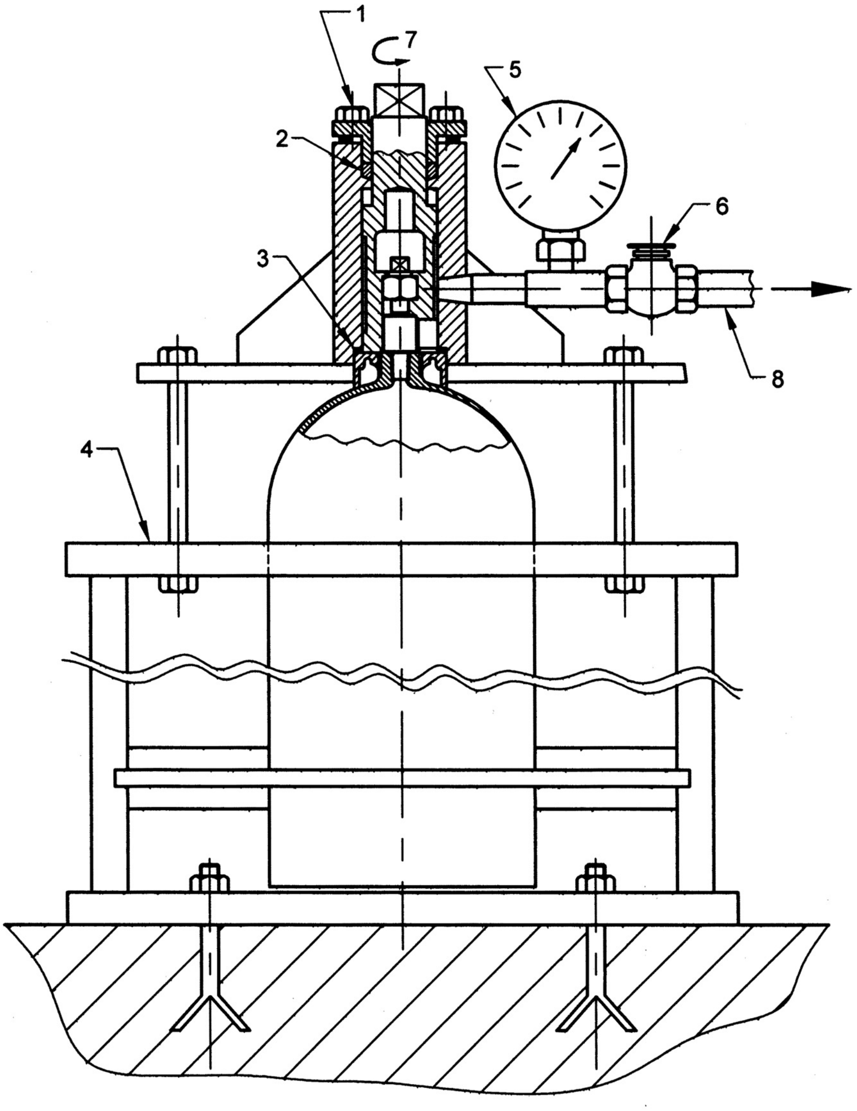
Cooling shall be provided, especially if toxic gases are involved; and

b) Loosen or pierce the safety device in a controlled manner.

These methods are applicable to cylinders of non-toxic, non-flammable, non-oxidizing and non-CFC gases. Appropriate safety precautions shall be taken to ensure that no hazard results from the uncontrolled discharge of any residual gas.

Where the contents are toxic, flammable, oxidizing or CFC, the preferred method is to unscrew partially the valve within a glanded cap, secured and joined to the cylinder and vented to a safe discharge. The principles of a suitable device are illustrated in Fig. 2.

These procedures shall be carried out only by trained personnel. When the gas, if any, has been released and the pressure within the cylinder reduced to atmospheric pressure, and, in the case of liquefied gases, when there is no frost or dew on the outside of the cylinder, the valve may be removed.



Key

1) Drive for De — Valving Machine	2) Gas Tight Gland
3) Gas Tight Seal	4) Cylinder Frame and Clamping Device
5) Pressure Gauge	6) Vent Valve
7) Direction of Rotation	8) Gas Disposal System

NOTE — Operate Remotely Using DE Velving Machine

FIG. 2 TYPICAL DEVICE FOR THE REMOVAL OF A DAMAGED GAS CYLINDER VALVE

ANNEX B

(*Clause* 7.2)

DESCRIPTION AND EVALUATION OF DEFECTS, AND CONDITIONS FOR REJECTION OF WELDED CARBON STEEL GAS CYLINDERS AT THE TIME OF VISUAL INSPECTION

B-1 GENERAL

Gas cylinder defects may be physical, material or due to corrosion as a result of environmental or service conditions to which the cylinder has been subjected during its life.

The object of this annex is to provide general guidelines for gas cylinder users on the application of rejection criteria. It is intended, in particular, for gas cylinder users with limited practical experience.

This annex applies to all cylinders, but those which have contained gases having special characteristics may require modified controls.

Any defect presenting a sharp notch may be removed by grinding, machining or other approved methods. After such a repair, the wall thickness shall be checked, for example ultrasonically, to ensure that the minimum design wall thickness has been maintained.

B-2 PHYSICAL OR MATERIAL DEFECTS

Evaluation of physical and material defects in the cylinder shall be in accordance with Table 1.

Permanent attachments (for example, foot-rings or shrouds) shall be inspected and shall be suitable for these intended purposes.

B-3 CORROSION

B-3.1 General

The cylinder get subjected to environmental conditions

Table 1 Rejection Limits Relating to Physical and Material Defects in the Cylinder Shell

(*Clauses* 7.2 *and* B-2)

Sl No. (1)	Type of Defect (2)	Definition (3)	Rejection Criteria (4)
i)	Bulge	Visible swelling of the cylinder	All cylinders with such a defect
ii)	Dent	A depression in the cylinder that has neither penetrated nor removed metal and is greater in depth than 1 percent of the outside diameter	When the depth of the dent exceeds 3 percent of the external diameter of the cylinder or when the diameter of the dent is less than 15 times its depth
iii)	Cut or gouge	A sharp impression where metal has been removed or redistributed (*see* Fig. 3) and whose depth exceeds 5 percent of the cylinder wall thickness	When the depth of the cut or gouge exceeds 20 percent of the wall thickness or when the length exceeds 25 percent of the outside diameter of the cylinder or when the wall thickness is less than the design minimum wall thickness
iv)	Crack	A split or rift in the metal (*see* Fig. 4)	All cylinders with such defects
v)	Fire damage	Excessive general or localized heating of cylinder usually indicated by, a) chaming or burning of paint b) distortion of cylinder c) partial melting of cylinder d) fire damage to valve, melting of plastic guard of date ring	All cylinders in categories Sl No. (v) b), c) or d) If only a) is evident, the cylinder may be accepted by a competent person if a satisfactory result is obtained on hardness check or the cylinder passes the volumetric expansion test
vi)	Plug or neck inserts	Additional inserts fitted in the cylinder neck, base or wall	All cylinders that has had a plug or neck insert fitted unless. It can be ascertained that the plug or neck insert is part of the approved design of the cylinder
vii)	Stamping	Marking by means of a metal punch	All cylinders with illegible, modified or incorrect marking
viii)	Arc or torch burns	Partial melting of the cylinder, the addition of weld metal or the removal of metal by scarfing or cratering	All cylinders with such defects
ix)	Suspicious marks	Marks introduced other than by the cylinder manufacturing process and approved repair	All cylinders with such defects
x)	Vertical stability	—	Deviation from verticality which could present a risk during service (especially if fitted with foot-ring)[1]

[1] Repair, if possible or render unserviceable.

NOTE — When applying the rejection criteria given in Table 1, the conditions of use of the cylinder, the severity of the defect and safety factors in the design shall be taken into consideration.

that could cause external corrosion of the metal. Internal corrosion of the metal can also occur owing to service conditions.

There is difficulty in presenting definite rejection limits in tabular form for all sizes and types of cylinders and their service conditions. The limits of rejection have been established following considerable field experience.

Extensive experience and judgment are required in evaluating whether cylinders that have corroded internally are safe and suitable for return to service. It is important that the surface of the metal is cleaned of corrosion products prior to the inspection of the cylinder.

B.3.2 Types of Corrosion

The types of corrosion may generally be classified as in Table 2.

Table 2 Rejection Criteria for Corrosion of the Cylinder Wall

(*Clauses* 7.2 *and* B-3.2)

Sl No.	Type of Corrosion	Definition	Rejection Criteria
(1)	(2)	(3)	(4)
i)	General corrosion	Loss of wall thickness over an area of more than 20 percent of either the interior or exterior total surface area of the cylinder (*see* Fig. 5)	If the original surface of the metal is no longer recognizable or if the depth of penetration exceeds 10 percent of the original wall thickness or if the wall thickness is less than minimum design wall thickness
ii)	Local corrosion	Loss of wall thickness over an area of less than 20 percent of either the interior or exterior total surface area of the cylinder, except for the other types of local corrosion described below in Sl No. iii), iv) and v)	If the depth of penetration exceeds 20 percent of the original thickness of the cylinder wall or if the wall thickness is less than minimum design wall thickness
iii)	Chain pitting or line corrosion	Corrosion forming a narrow longitudinal or circumferential line or strip, or isolated craters or pits which are almost connected (*see* Fig. 6)	If a total length of corrosion in any direction exceeds the diameter of the cylinder and the depth exceeds 10 percent of the original wall thickness or if the wall thickness is less than minimum design wall thickness
iv)	Isolated pits	Corrosion forming isolated craters, without significant alignment (*see* Fig. 7)	If the diameter of the pits is greater than 5 mm, refer to the local corrosion at Sl No. ii) If the diameter of the pits is less than 5 mm, the latter should be assessed as carefully as possible in order to check that the remaining thickness of the wall or base is adequate for the intended use of the cylinder
v)	Crevice corrosion	Corrosion associated with taking place in, or immediately around, an aperture	If, after thorough cleaning, the depth of penetration exceeds 20 percent of the original wall thickness

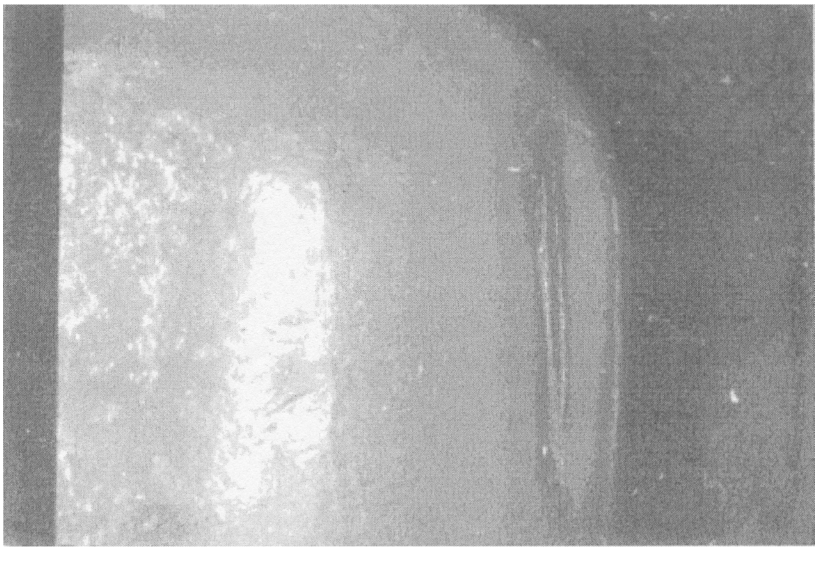


FIG. 3 CUT OR GOUGE

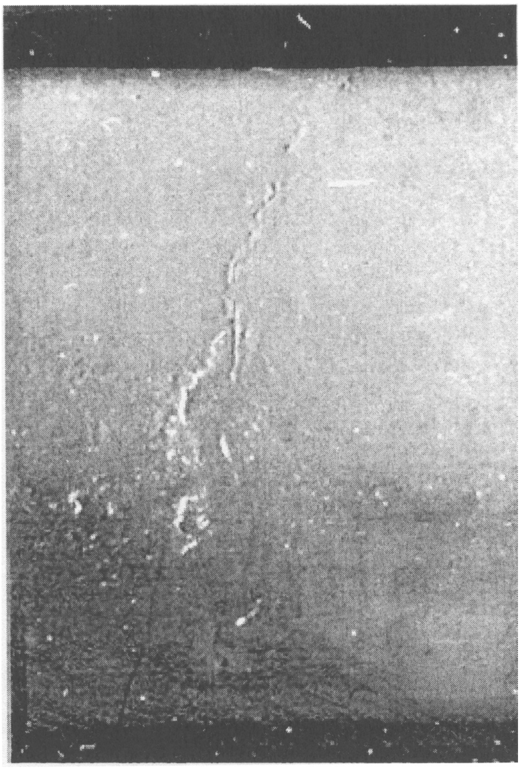


FIG. 4 CRAKE

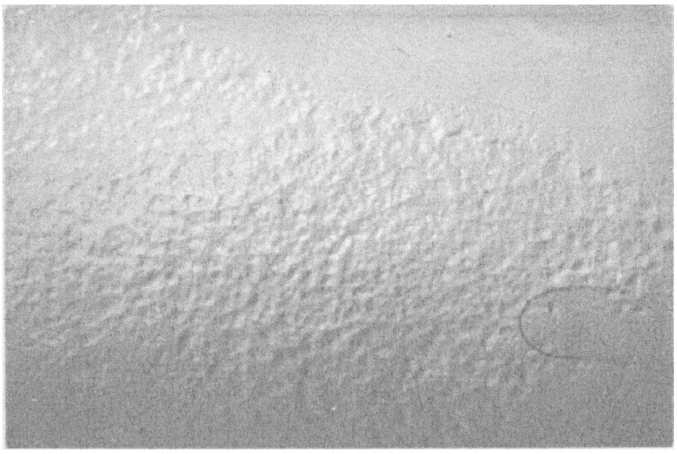


FIG. 5 GENERAL CORROSION

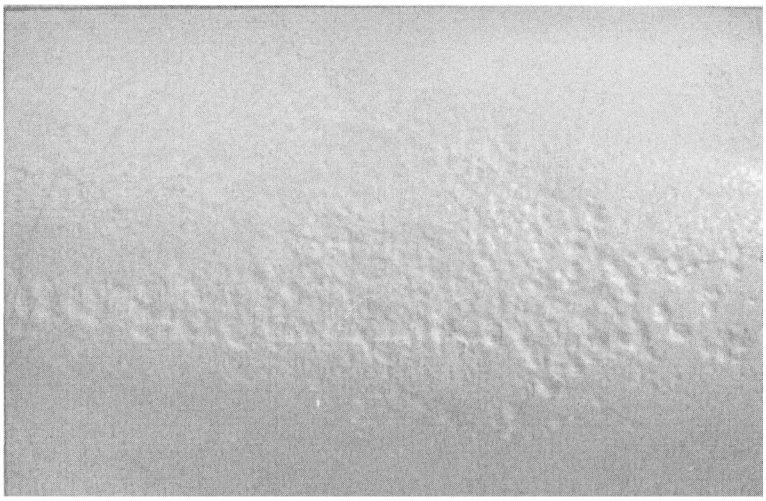


FIG. 6 LINE CORROSION

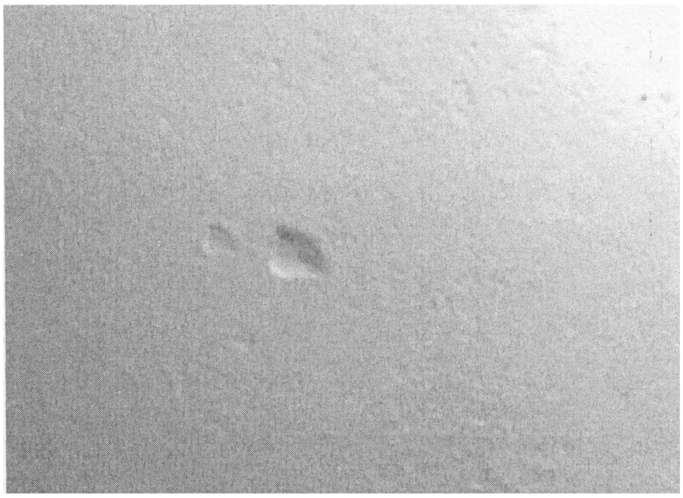


FIG. 7 ISOLATED PITS

ANNEX C

(*Foreword*)

COMMITTEE COMPOSITION

Gas Cylinders Sectional Committee, MED 16

Organization	*Representative*(*s*)
Petroleum and Explosive Safety Organization, Nagpur	Shri T. R. Thomas (***Chairman***) Shri D. K. Gupta (*Alternate*)
All India Industrial Gases Manufacturers Association, New Delhi	Shri Saket Tiku Shrimati Veena Peter (*Alternate*)
Bharat Petroleum Corporation Limited, Mumbai	Shri J. Vedagiri Shri Sanjay Phulli (*Alternate*)
Bharat Pumps and Compressors Limited, Allahabad	Shri Mohan Kumar Shri P. G. Choudhury (*Alternate*)
BOC India Limited, Kolkata	Shri K. Manoharan Shri Ramana Vutukuru (*Alternate*)
Everest Kanto Cylinder Limited, Mumbai	Shri P. M. Samvatsar Shri A. K. Khamkar (*Alternate*)
Hindustan Petroleum Corporation Limited, Mumbai	Shri M. Selvakumar Shri Alok Kumar Gupta (*Alternate*)
Indian Oil Corporation Limited, Mumbai	Shri Shankar Sharan Shri S. M. Rambhal (*Alternate*)
Indraprastha Gas Limited, New Delhi	Shri Praveen K. Pandey Shri Ujwal Bhandari (*Alternate*)
International Industrial Gases Limited, Kolkata	Shri Devendra K. Garg Shri Nikhilesh K. Garg (*Alternate*)
Kabsons Gas Equipments Limited, Hyderabad	Shri Satish Kabra Shri S. Gopalaiah (*Alternate*)
Kosan Industries Limited, Surat	Shri S. K. Dey Shri S. B. Bomal (*Alternate*)
LPG Equipment Research Centre, Bangalore	Shri U.V. Mannur Shrimati Karobi Mukherjee (*Alternate*)
Mahanagar Gas Limited, Mumbai	Shri Raghunath Kulai Shri Arun Nayak (*Alternate*)
Maruti Koatsu Cylinders Limited, Mumbai	Shri Nitin J. Thakkar Shri A. S. Saran (*Alternate*)
Ministry of Defence (DGQA), Pune	Shri J. P. Tiwari Shri K. Sudhakaran (*Alternate*)
Praxair India Limited, Bangalore	Shri Milan Sarkar Shri Arindam Das (*Alternate*)
Research and Development Establishment (Engineers), Pune	Shri P. K. Chattopadhyay Shri A. Basu (*Alternate*)
Sakha Engineers Private Limited, New Delhi	Shri Amarjit S. Kohli
SICGIL India Limited, Chennai	Shri Farooque Dadabhoy Shri R. Padmanaban (*Alternate*)
Society of Indian Automobile Manufacturers (ARAI), New Delhi	Shri K. K. Gandhi Shri Pankaj Kumar Karn (*Alternate*)
Steel Authority of India Limited, Salem	Shri M. Prabakaran Shri N. K. Vijayavargia (*Alternate*)
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This Indian Standard has been developed from Doc No.: MED 16 (1160).

Amendments Issued Since Publication

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Published by BIS, New Delhi